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IS 5967-1 (1988): Methods of test for strength and stability of tables and trolleys, Part 1: Strength [CED 35: Furniture]



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Indian Standard

IS : 5967 (Part 1) - 1988

METHODS OF TEST FOR STRENGTH AND STABILITY OF TABLES AND TROLLEYS

PART 1 STRENGTH

(First Revision)

UDC 684.44.041 : 620.1

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*Indian Standard***METHODS OF TEST FOR STRENGTH
AND STABILITY OF TABLES AND TROLLEYS****PART 1 STRENGTH***(First Revision)***0. FOREWORD**

0.1 This Indian Standard (First Revision) was adopted by the Bureau of Indian Standards on 2 August 1988, after the draft finalized by the Furniture Sectional Committee had been approved by the Civil Engineering Division Council.

0.2 In view of the fast expanding furniture industry in the country and the trends of manufacturers to industrialize and mechanize processes, it has become possible to produce items of furniture and special office furniture to strict standards of accuracy and strength and also in view of the general quality consciousness among the average purchaser of furniture, it seems reasonable to lay down, at this stage of development, proper performance requirements for some items of furniture. It is with this end in view that this standard has been prepared to make available to the testing laboratories and purchase organisations information with regard to the methods of tests for ascertaining the same.

0.3 This standard, first published in 1969, covered method of test to assess functional and strength requirements of wooden tables. Now the scope of

the standard has been enlarged to cover the tables and trolley of any material. This standard is being issued in 2 parts. Part 1 covers the methods of test for the determination of strength of tables and trolleys.

0.4 Part 2 of this series covers the methods of test for stability requirements of tables and trolleys.

0.5 In the formulation of this standard, considerable assistance has been derived from BS 4875: Part 5: 1985 'Strength and stability of furniture, Part 5 Methods of determination of strength of tables and trolleys', issued by the British Standards Institution.

0.6 For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS : 2-1960*. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

*Rules for rounding off numerical values (*revised*).

1. SCOPE

1.1 This standard lays down the methods of test for the determination of strength of tables and trolleys.

2. PRINCIPLE

2.1 General — The principle is to determine the strength of the structure of an article of furniture by applying to various parts, loads or forces simulating normal functional use.

Test loading is given in Table 1.

The sequence as a whole determines the following:

- a) static strength and initial damage,
- b) fatigue strength and damage propagation, and
- c) ability to withstand acceptable mis-use.

The severity of loading is graded by varying the number of applications or the magnitude of forces applied (*see* Table 2).

NOTE — In strength testing, should trolleys be intended for heavier loads than the maximum loads specified, representative loads should be used during testing.

2.2 Static Tests — The principle of static tests is to assess the static strength of the article under the high levels of loading that only occasionally occur.

2.3 Fatigue Tests — The principle of fatigue tests is to assess the strength of the component parts of the article under the repeated operations, movement or applications of loads occurring during daily use.

2.4 Impact Tests — The principle of impact tests is to assess the impact strength of the article under the rapid rates of loading that only occasionally occur.

TABLE 1 TEST LOADINGS

(Clause 2.1)

TITLE	DESCRIPTION	TEST LEVEL (see TABLE 2)				
		1	2	3	4	5
Vertical static load test	Test force (N)	500	750	1 000	1 250	2 900
	a) main working surface					
	b) ancillary working surface	125	250	350	500	750
Sustained load test	Test load (kg/mm ²)	0.01	0.01	0.015	0.02	0.025
Horizontal static load test	Test force (N)	175	300	450	600	900
Vertical impact test	Drop height (mm)	—	140	180	240	300
Drop test	Drop height (mm)	100	150	200	300	600
Horizontal fatigue test	Number of cycles: 150 N test force	5 000	10 000	15 000	30 000	60 000
Vertical fatigue test for cantilever or pedestal tables	Number of cycles: 300 N test force	5 000	10 000	15 000	30 000	60 000

NOTE — The vertical impact test on horizontal surfaces is not to appreciate at test level 1 and, therefore, no value is given.

3. GENERAL REQUIREMENTS FOR TESTS

3.1 Test Loading — All loads and forces shall be measured to an accuracy of ± 5 percent.

NOTE — The tests may, in certain cases, be carried out by means of loads or forces. For practical purposes, a force of 10 N may be taken to be equal to the downward force due to a mass of 1 kg.

3.2 Moisture Content and Conditioning — Before the tests are commenced, the article shall be sufficiently old to ensure that all component materials have developed their full strength. At least 4 weeks in normal conditions shall elapse from manufacture in the case of glued joints in timber, plastics moulded parts, etc.

TABLE 2 SPECIFIC APPLICATION FOR FURNITURE IN RELATION TO TEST LEVELS

(Clause 2.1)

TYPE OF USE	STRENGTH OF FRAME (TEST LEVEL)				
	1	2	3	4	5
Folding garden and camping		×	×		
Domestic	×	×	×	×	
Office			×	×	×
Educational				×	×
Institutional					×
Hotel			×	×	
Non-specialized hospital			×	×	×
Military					×
Police station				×	×
Recreation room					×
Common room					×
Public hall				×	×

Parts made of timber products shall be checked with an electric moisture meter to ensure that the moisture content is between 12 and 15 percent. If the moisture content is too high, the article shall be allowed to dry out in a warm ventilated room until the moisture content is between 12 and 15 percent.

If a standard atmosphere is required for conditioning or testing, that atmosphere shall be a temperature of $27 \pm 3^\circ\text{C}$ and a relative humidity of 65 ± 5 percent.

3.3 Rate of Carrying Out the Tests — The forces shall be applied at a sufficiently slow rate to ensure that negligible dynamic load is applied and also to ensure that kinetic heating does not occur.

During the static load tests (6.1 and 6.3), the forces shall be maintained for at least 10 s during each cycle.

NOTE — It is recommended that the tests are carried out at a maximum rate of six cycles per minute.

3.4 Setting-Up of Furniture — The articles shall be tested as delivered. Self-assembly furniture shall be assembled according to instructions supplied with the article. If the article can be combined in different ways, the most adverse combination shall be used for each test. This requirement shall also apply to furniture that can be combined with other article.

4. INSPECTION BEFORE AND AFTER TESTING

4.1 Immediately before commencement of testing, each article shall be thoroughly inspected. Any defects in the members, joints or attachments shall be noted so that they are not attributed to the effect of the tests when the tests have been

completed. A complete dimensional check shall be carried out on all articles that may suffer permanent deformation as a result of testing.

Immediately after completion of the tests, the article shall again be thoroughly inspected. Any apparent defects shall be noted and a determination made of any changes that have taken place since the initial inspection.

Fittings in self-assembly furniture shall be tightened before testing, and after each test level, if testing is carried out at more than one test level.

Each article shall be subjected to each of the tests at the same test level in the order specified and the occurrence of any of the following shall be recorded as defects affecting the strength of the article:

- a) any fracture of any member, joint or component;
- b) any loosening, shown to be permanent by hand pressure applied to suitable members, of joints intended to be rigid;
- c) any free movement in the top, legs or components of the article greater than that noted in the initial inspection;
- d) any deformation of any part that will adversely affect the function or appearance of the article; and
- e) any clearly audible noise developed during testing.

NOTE 1 — The test can be carried out on glass topped articles, but the tests do not guard against accidental damage.

NOTE 2 — Fittings in self-assembly furniture that come loose during the tests do not constitute a test failure. Manufacturers of self-assembly furniture should be recommended to issue instructions with the furniture that such fittings should be tightened occasionally.

5. APPARATUS

5.1 Means of applying required loads or forces.

5.2 Means of measuring dimensions to an accuracy of ± 0.2 mm.

5.3 Stops, to prevent the article from sliding but not from overturning. Stops shall be not higher than 12 mm except in cases where the design of the article necessitates the use of higher stops, where the lowest stop that will prevent the article from moving shall be used.

5.4 Floor, comprising a rubber mat 2 mm according to IS : 809-1970*.

5.5 Impactor, a mass that is free to move in relation to the rest of the assembly approximately 200 mm in diameter separated from the striking surface by means of springs.

The moving parts, less the springs, have a mass of not less than 17 kg, and the whole apparatus has a mass of 25 ± 0.1 kg. The springs are 400 ± 5 mm long with a closed length of 124 ± 5 mm, a spring rate of 0.69 ± 0.1 kg/mm and are set to a working length of 253 ± 0.5 mm. The striking surface is an approximately flat leather pad containing fine dry sand.

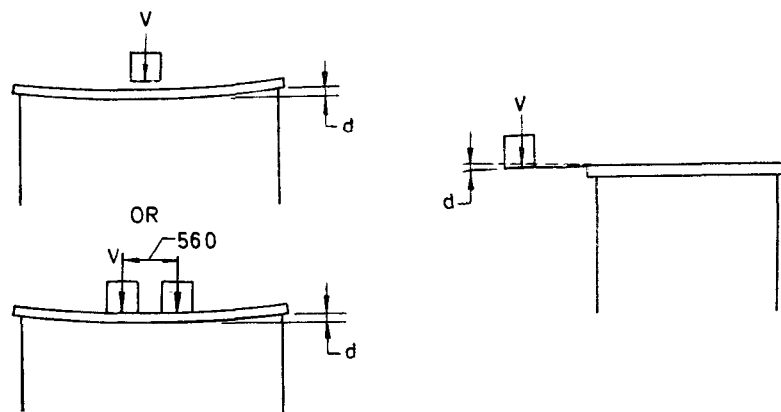
5.6 Loading Pad — 75 mm \times 75 mm, having a smooth hard surface and rounded edges.

5.7 Loads — Loads for loading the article during testing, shall be masses that do not reinforce the structure or redistribute the load. If metal bars are used, the front row of masses shall be aligned with the front edge of the surface. If bags with lead shot, etc, are used, the bags shall be divided into small compartments to prevent the contents moving during the test.

6. PROCEDURES

6.1 Vertical Static Load Test — Apply a vertical downward force, V , of the appropriate magnitude specified in Table 1. Apply the force 10 times using the loading pad (5.6) anywhere on the top that is likely to cause a failure. If there are several such positions, repeat the test (see Fig. 1).

*Specification for rubber flooring materials for general purposes (first revision).



All dimensions in millimetres.

FIG. 1 VERTICAL STATIC LOAD TEST

For test levels 1 to 4, use a single vertical downward force, but for test level 5, use two vertical downward forces spaced 560 mm apart, equidistantly spaced about the point of load application.

Repeat the test on each ancillary working surface, for example, flaps or leaves, using the appropriate force specified in Table 1 (see Fig. 1). If the article tends to overturn, load the main working surface sufficiently to prevent overturning. Measure the maximum deflection, d , in mm, as shown in Fig. 1.

6.2 Sustained Load Test — If the deflection of the main working surface of the article measured in 6.1 exceeded span/150 for wood based products, span/250 for particle board or span/100 for other materials, carry out the sustained load test.

Position the article on the floor (5.4) and load the top evenly with the appropriate load specified in Table 1. Leave load for 7 days and measure the maximum deflection of the top.

6.3 Horizontal Static Load Test — Restrain the base of article by stops placed at the opposite end to that at which the horizontal test force is applied. Leave the stops in position for the reversal of the application of the horizontal test force. If an article is non-symmetrical about its lateral centre line, carry out the tests first with the stops positioned at one end and then repeat with the stops at the opposite end. In the case of mobile items, place the stops against the castors, etc (see Fig. 2). If the article tends to overturn during the test, uniformly apply an additional mass, M (see Fig. 2), of sufficient magnitude of up to 100 kg to just prevent over-turning.

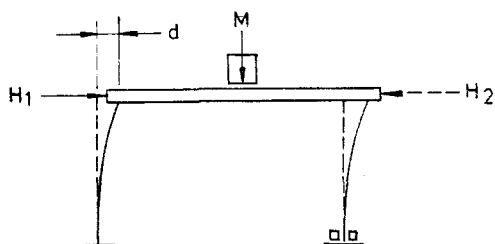


FIG. 2 HORIZONTAL STATIC LOAD TEST

Apply a horizontal force, H_1 (see Fig. 2) of the appropriate magnitude specified in Table 1 by means of the loading pad (5.6). Apply the force 10 times to the top along the longitudinal centre line of the top. Measure the movement of the article, d , in mm during the first and last cycle.

Apply a horizontal force, H_2 (see Fig. 2) by means of the loading pad along the longitudinal centre line in the opposite direction. Measure the movement of the article, d , in mm during the first and last cycle.

Repeat the above loading cycle along the transverse centre line of the top in two directions. Leave the stops in position for the reversal of the application of the horizontal test force.

If, with an additional mass of 100 kg, the article tends to overturn in one direction of loading, reduce the horizontal force in that direction only to the highest value that prevents overturning. Record the value of any reduced force used.

6.4 Vertical Impact Test — Allow the impactor (5.5) to fall onto the top from the appropriate height specified in Table 1. Allow the impactor to fall 10 times as close as possible to the point of support of the top and 10 times onto the centre of the edge of the longest span.

In case of centilever tables, apply the impact to the edge furthest away from the support of the top.

NOTE — This test is intended to test the structure and not the surface finish. Hence, damage on the surface finish can be ignored when examining the article after test (see 4).

6.5 Drop Test

6.5.1 Non-stacking Tables — Lift up the article, at one short end, to the appropriate height given in Table 1 and allow to fall freely towards the floor (5.4). Repeat 10 times.

6.5.2 Stacking Tables — Support the table so that at impact of one leg, the line joining that leg to the diagonally opposite leg is inclined at 20° to the horizontal, while the line joining the remaining feet is horizontal. Lift up the table to the appropriate height specified in Table 1 and allow to fall onto the floor (5.4). Drop the table 10 times onto one leg and 10 times onto a diagonally opposite leg.

NOTE — This test can be carried out by lifting the stacking table by three cords that are adjusted in length with the table standing in the correct orientation in a plane inclined as 20° to the horizontal (see Fig. 3).

6.6 Fatigue Tests

6.6.1 General — During these tests, restrain the base of the article by stops in all directions.

If the article tends to overturn during the tests, uniformly apply an additional mass of sufficient magnitude up to 100 kg to just prevent overturning.

6.6.2 Horizontal Fatigue — Restrain the base of the table with stops in all directions around all the legs. In the case of mobile items, place the stops against the castors, etc.

Apply two horizontal forces of 150 N by means of two loading pads (5.6), one at the edge of the article 50 mm from one corner, a (see Fig. 4) and one at the opposite edge, b (see Fig. 4). Apply the force for the appropriate number of cycles specified in Table 1.

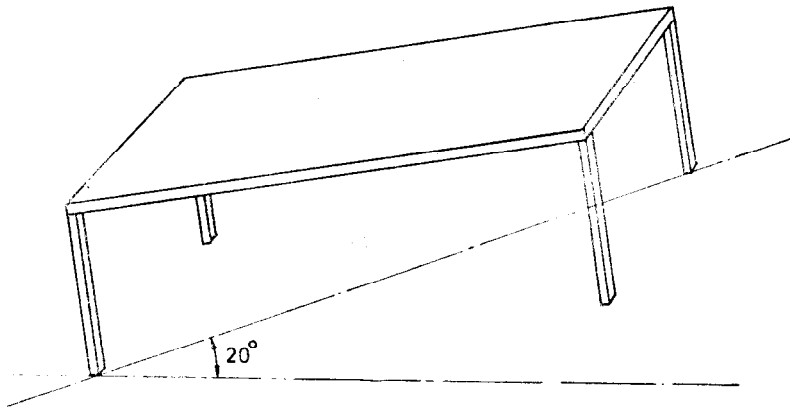
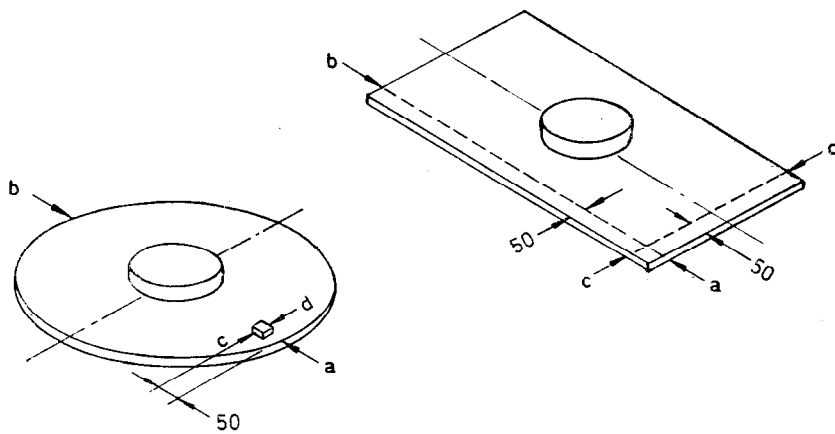
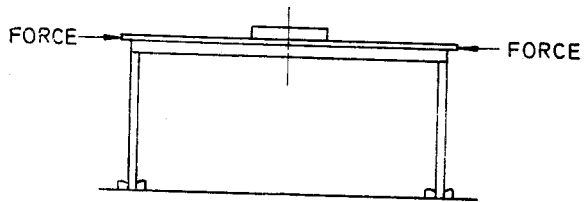
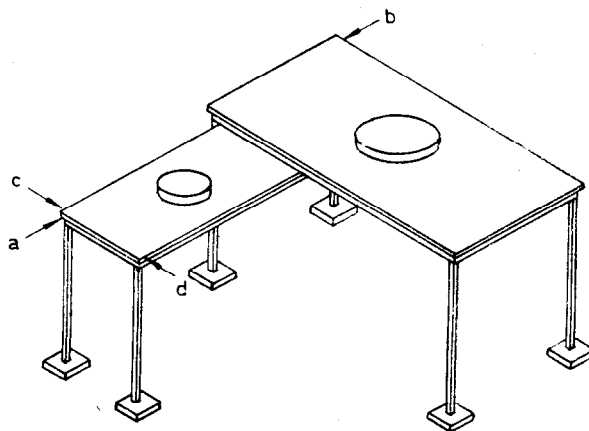


FIG. 3 DROP TESTING FOR STACKING TABLES



ROUND, OVAL AND
ELLIPTICAL TABLE



All dimensions in millimetres.
FIG. 4 HORIZONTAL FATIGUE TEST

Repeat the test at the other corner positions, *c* and *d* (see Fig. 4).

If the article tends to overturn in one direction of loading with the maximum load on the table specified in Table 1, reduce the horizontal force to the highest value that prevents overturning. Perform the test using this reduced force in that direction only. Record the value of any reduced force used.

For a smaller table, that is not considered as a main working surface, attached to a larger table at one end, in addition, apply the forces as shown in Fig. 4. The additional force on the table shall be as given in Table 1 for the ancillary working surface.

6.6.3 Vertical Fatigue Test for Cantilever and Pedestal Tables — Apply a vertical downward force of 300 N through the smaller loading pad (5.6) at the centre of the working edge of the top. Apply the force for the appropriate number of cycles specified in Table 1.

7. INTERPRETATION OF RESULTS

Each article shall be considered to have passed the tests at the appropriate test level if no defects are observed (see 4) and if:

- a) no permanent deflection of the legs greater than table height/14 was recorded after testing;
- b) in the sustained load test (6.2) no deflection exceeding span/250 for particle board, span/150 for wood or span/100 for other materials was recorded;
- c) in the horizontal static load test (6.3), no deflection exceeding 1 mm for every 25 N of horizontal force applied was recorded; and

- d) the requirements of the appropriate product specification are met.

NOTE — See also Note 2 to 4 concerning fittings in self-assembly furniture.

8. TEST REPORT

The test report shall include the following particulars:

- a) details of the article tested;
- b) the test level that the article has been tested against;
- c) details of any defects observed before the tests;
- d) details of any defects observed after the tests; and
- e) the test result, pass or fail.

9. SAMPLING OF TABLES AND TROLLEYS

9.1 The samples shall be drawn at random from a lot in accordance with Table 3.

TABLE 3 SCALE OF SAMPLING AND PERMISSIBLE NUMBER OF DEFECTIVES

LOT SIZE (No. IN THE LOT)	SAMPLE SIZE (No. TO BE SELECT- ED FOR SAMPLE)	PERMISSIBLE NUMBER OF DEFECTIVES
(1)	(2)	(3)
Up to 50	3	0
51 to 150	5	0
151 to 300	8	0
301 to 500	13	0
501 to 1 000	20	1
1 001 to 3 000	32	2
3 001 and above	50	3

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